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MULTIFUNCTIONAL OVERHAD PROJECTOR

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Specification

1. Title of the invention

Multifunctional Overhead Projector

2. Claims

1. A multifunctional overhead projector, characterized by the fact that in an overhead projector consisting of a light source that illuminates an image drawn on a transparent original sheet from the back and an imaging optical system that projects the illuminated image on a screen, it is equipped with a scanning image sensor that mounts a reflective body on the above-mentioned original sheet, reads out the above-mentioned image by scanning while receiving a light reflected by the above-mentioned reflective body when the image is illuminated by the above-mentioned light source, and converts it into an electric signal and a printer that prints the above-mentioned image based on the above-mentioned electric signal.

[1] Numbers in the margin indicate pagination in the foreign text.

2. A usage method of a multifunctional overhead projector, characterized by the fact that in an overhead projector equipped with a light source that illuminates an image drawn on a transparent original sheet from the back, an imaging optical system that projects the illuminated image on a screen, a scanning image sensor that mounts a reflective body on the above-mentioned original sheet, reads out the above-mentioned image by scanning while receiving a light reflected by the above-mentioned reflective body when the image is illuminated by the above-mentioned light source, and converts it into an electric signal, and a printer that prints the above-mentioned image based on the above-mentioned electric signal, the above-mentioned light source is put out; an external image is formed at the position of the above-mentioned original sheet or at its vicinity by using the above-mentioned imaging optical system, read out by the above-mentioned image sensor, and converted into an electric signal; the signal is input into the above-mentioned printer; and the external image is printed.

3. The multifunctional overhead projector of Claim 1, characterized by the fact that a light-emitting pattern for focusing the above-mentioned external image is installed at the same position as that of the above-mentioned original sheet or its vicinity.

4. The multifunctional overhead projector of Claim 1, characterized by the fact that an external illuminating light source for illuminating the above-mentioned external image is installed. /2

3. Detailed explanation of the invention

(Technical field of the invention)

The present invention pertains to a multifunctional overhead projector.

(Background of the invention)

A basic structure of a conventional overhead projector (hereinafter, abbreviated to OHP), as shown in Figure 2, consists of a light source (1) that illuminates an image drawn on a transparent original sheet (G), a reflecting mirror (2) with a concave surface that condenses a light source light in one direction, a Fresnel lens (3) that condenses an illuminating light, a transparent stage such as glass plate (4) that mounts the original sheet (G), an imaging lens (5) that condenses the illuminating light containing the image information transmitted through the original sheet (G) and projects the image on a screen (S), and a mirror (6) that bends the transmitted light of the imaging sensor in the screen direction. Here, the Fresnel lens (3) has a role of introducing the illuminating light from

the light source (1) with good efficiency into an effective diameter of the imaging sensor (5), and the imaging lens (5) and the mirror (6) constitute an imaging optical system that forms the image of the original sheet (G) placed on the transparent stage (4) and a conjugate image on the screen (S).

Thus, the conventional OHP simply projects the image of the original sheet on the screen.

(Purpose of the invention)

The purpose of the present invention is to obtain an OHP having a function that projects an image on an original sheet on a screen and can copy (print) the image on the spot and a function that can copy (print) an external image drawn on blackboard, whiteboard, etc., on the spot.

(Outline of the invention)

Therefore, first, the present invention provides a multifunctional overhead projector characterized by the fact that in an overhead projector consisting of a light source that illuminates an image drawn on a transparent original sheet from the back and an imaging optical system that projects the illuminated image on a screen, it is equipped with a scanning image sensor that mounts a reflective body on the above-mentioned original sheet, reads out the above-mentioned image by scanning while receiving a light reflected by the above-

mentioned reflective body when the image is illuminated by the above-mentioned light source, and converts it into an electric signal and a printer that prints the above-mentioned image based on the above-mentioned electric signal.

On the other hand, the OHP of the present invention has a copying function, and if the imaging optics is reversely applied, an external image itself drawn on the screen or an external image or scene color drawn on blackboard, whiteboard, etc., can be formed as an actual image at the position of the original sheet.

In this constitution, the external image is equivalent to the image drawn on the original sheet and can be read out by the internal image sensor, that is, can be copied (printed) by the printer.

Therefore, secondly, the present invention provides a usage method of the multifunctional overhead projector characterized by the fact that in the multifunctional OHP of the present invention, the illuminating light source is put out; an external image is formed at the position of the original sheet or at its vicinity by using the imaging optical system, read out by the image sensor, and converted into an electric signal; the signal is input into the printer; and the external image is printed.

Next, the present invention is explained in detail by application examples, however the present invention is not limited to them.

(Application Example 1A)

Figure 1 is a conceptual diagram showing the OHP of an application example of the present invention and shows the case where an original sheet (G) placed on a glass stage (4) is copied. The original sheet (G) is placed with the imaging face down oppositely to the projection. Then, since the original sheet (G) is a transparent sheet, there is no reflecting light, even by illuminating. Thus, a reflective body (R) is placed on the original sheet (G). If a image drawn on a transparent paper such as plain paper instead of the original sheet (G), the reflective body (R) is not required, and this case is also included in the scope of the present invention.

In the OHP of the present invention, compared with the conventional OHP, an illuminating light (including a reflecting light from a reflecting mirror (2) with a concave surface, and hereinafter, similarly applied) emitted form a light source (1) transmits through a Fresnel lens (3), and while holding the optical system within an effective diameter of an imaging lens (5), a glass stage (4) is closely adhered to the Fresnel lens

(3). Here, a space where a scanning image sensor (7) can be /3 moved is given.

An illuminating light (8) from the light source (1) transmits through the Fresnel lens (3) and reaches the original (G) closely adhered to the glass stage (4) by a convergent optical fiber array (7a) as shown in Figure 3, and the light reflected by the reflective body (R) on it is condensed to an image sensor light-receiving part (7c) by a rod lens array (7b) and converted into an electric signal. The image sensor light-receiving part (7c) is formed on a light-shielding layer (7e) attached to a substrate (7d), and a number of light-receiving elements are continuously distributed in the direction (called a horizontal scanning) perpendicular to the paper. The image sensor (7) can read out the entire original surface by reading the image information of the original (G) while moving (scanning) in the arrow direction (called a vertical scanning direction) of Figure 1. The electric signal obtained by the image sensor 7 is sent to a printer (11) through a signal processing circuit (10) by a flexible signal line (9).

Figure 1 shows the method using a heat-sensitive paper (12) and a thermal head (11a), however the printer (11) may also be thermal transfer method, ink-jet method, electrosensitive recording method, electrolytic recording method, electrostatic

recording method, electrifying heat-sensitive recording method, pressure-sensitive method, and electrophotographic method in addition to that. The paper copied is discharged from a drawing-out port (13).

Also, the image sensor (7), as shown in Figure 4, may also have an illuminating light source (7f) for copying the original, and in this case, the light-shielding layer (7e) on the substrate (7d) can be omitted. This case is also included in the present invention.

(Application Example 1B)

As shown in Figure 5, when an ordinary OHP is used, the Fresnel lens (3) exists at a position (Po) shown by a dotted line, and an illuminating light from the light source (1) is guided to the effective diameter inside (shown by an alternate long and short dash line) of the imaging sensor (5). Next, when the original (G) is copied, the Fresnel lens (3) is descended to a position (Pc) where the illuminating light (8) from the light source (1) passes through the Fresnel lens (3) and becomes a parallel light. The original (G) can be uniformly illuminated by the parallel light. The principle from the operation of the original readout of the image sensor to the acquisition of the printer output is the same as that of Application Example 1A.

Thus, with the movement of the Fresnel lens (3) to an appropriate position (Pc), the illuminating light can be effectively utilized when copying as well as projecting.

(Application Example 2A)

An application example in which an external image drawn on a blackboard and the like (K) by using the copying OHPs explained in Application Examples 1A and 1B is explained by Figure 6. In this case, the light source (1), reflecting mirror (2) with a concave surface, Fresnel lens (3), and optical fiber array (7a) are not used.

The external image drawn on the blackboard, etc., (K) which receive an external light illumination of indoor illumination, etc., and a conjugate image are formed at the original sheet position or at its vicinity by adjusting the position of the imaging lens (5). This optical path is the same as that of the OHP usage, that is, the projection of the image of the original sheet on the screen, and only the advancing direction of the light is opposite. Therefore, since the light imaged on the glass stage (4) reaches the image sensor light-receiving part (7c) through the rod lens array (7b), the external image can be read out by the image sensor. However, even if the external image on the blackboard, etc., (K) is formed on the glass stage (4), since it cannot be seen with the naked eyes, its focusing

is impossible. Accordingly, after placing a pattern for focusing on the glass stage (4), it is confirmed that this pattern is projected with a correct focus on the blackboard, etc. (K), or after installing a light-emitting pattern (14) using a light-emitting element at the end of the glass stage (4), it is confirmed that it is projected with a correct focus on the blackboard, etc. (K). The light-emitting pattern (14), as shown in Figure 7, may also consist of a master (14a) having a cross-shaped transmitting part and a light source (14b) for illuminating it, for instance.

In any cases, when the external image is copied, the light source (1) and the light-emitting pattern (14) are turned off.

The electric signal obtained by the image sensor light-receiving part (7c) is sent to the printer by a principle similar to that of Application Example 1A, and the external image is copied.

(Application Example 2B)

In Application Example 2A, the blackboard, etc. (K) are illuminated using an external light, whereas in this /4 application example, an external illuminating light source (40) is separately installed (see Figure 8). The light source (40) is attached with a reflecting mirror (41) and installed an the angle for illuminating the entire surface of the blackboard,

etc. (K). With this constitution, the quantity of light being received by the image sensor light-receiving part (7c) is increased, and an electric signal with a high SN ratio is obtained. Furthermore, a light chopper (not shown in the figure) is installed on the front of the light source (40), and a synchronous pulse being generated from it is given to the signal processing circuit (10), so that a noise component due to a stray light directly incident on the image sensor light-receiving part (7c) is removed. The focusing method and the print outputting method are the same as those of Application Example 2A.

(Application Example 2C)

In Application Example 2B, the area being illuminated by the light source (40) is fixed, regardless of the size of the blackboard, etc. (K). However, if the blackboard, etc. (K) are made large, the illuminating area is expanded, and if the blackboard, etc., are made small, the illuminating area is decreased. The illuminance is raised by this principle. It is shown in Figure 9.

Figure 9 shows a strut and a mechanism being included in a movable case (44). In a focus adjustment, a gear (46) is rotated by the rotation of a handle (45) connected to a shaft (47) and vertically moved along a parallel gear (43). At that

time, if the handle (45) is rotated to vertically move the movable case (44), since a shaft (48) with cut screw mountains is connected with the shaft (47), it is rotated together, and a mount (49) with screw holes is also horizontally moved. A shaft (51) passes through the mount (49) and prevents the mount (49) itself from being rotated with the rotation of the shaft (47). Since a lamp (41) and a reflecting mirror (42) are fixed to the case (44), if the mount (49) moves horizontally, the spreading direction of an illuminating light (52) is changed by a lens (50) existing on the mount (49). The reason why a concave lens is shown as the lens (50) of Figure 9 is that the screws formed on the shaft (48) and the mount (49) is opposite screws. Therefore, using a convex lens as the lens (50), the shaft (48) and the mount (49) may also have regular screws.

(Effects of the invention)

As mentioned above, if the OHP of the present invention is used, an image being projected or a projected image can be copied (printed) on the spot, and an image drawn on an opaque original sheet that cannot be projected can also be copied (printed). Therefore, in the latter case, if a transparent original sheet is used as a sheet for copying, even if the image drawn on the opaque original sheet cannot be originally projected, since the image can be copied to the transparent

original sheet on the spot by the OHP of the present invention, it can be immediately projected.

Also, with the use of the OHP of the present invention, an external image drawn on blackboard, etc., can be printed (copied) on the spot.

4. Brief description of the figures

Figure 1 is a conceptual diagram showing the cross section structure of the OHP in the case where an image on a transparent original sheet is copied by the OHP of Application Example 1A of the present invention (first invention).

Figure 2 is a conceptual diagram showing the cross section structure of a conventional OHP.

Figure 3 is a partially enlarged diagram showing the vicinity of an image sensor of Figure 1.

Figure 4 is a conceptual diagram showing the structure of an image sensor with a structure different from the image sensor used in Application Example 1A.

Figure 5 is a conceptual diagram showing the cross section structure of the OHP in the case where an image on a transparent original sheet is copied by the OHP of Application Example 1B of the first invention.

Figure 6 is a conceptual diagram showing the cross section structure in the case where an external image is copied by the OHP used in Application Example 2A of the present invention (second invention).

Figure 7 is an illustrative diagram showing a light-emitting pattern that may be also be installed in the OHP of Application Example 2A. (1) is an illustrative diagram corresponding to its plan view, and (2) is an illustrative diagram corresponding to its cross section.

Figure 8 is a conceptual diagram showing the cross section structure in the case where an external image is copied by the OHP used in Application Example 2B of the second invention.

Figure 9 is a conceptual diagram showing a mechanism for being able to change the size of the illuminating area of an external illuminating light source of the OHP used in Application Example 2C of the second invention.

Explanation of symbols of the main parts:

1 Light source

2 Reflecting mirror with a concave surface

3 Fresnel lens

5 Imaging lens Imaging optical system

6 Mirror

4 Transparent (glass) stage for mounting an original sheet

7 Image sensor

7a Convergent optical fiber array

7b Rod lens array Image sensor (7)

7c Image sensor light-receiving part

8 Illuminating light

9 Signal line through which an electric signal passes

10 Signal processing circuit

11 Thermal printer

11a Thermal head

12 Heat-sensitive paper

13 Copy drawing-out port

14 Light-emitting pattern for focusing

40 External illuminating light source

41 Reflecting mirror

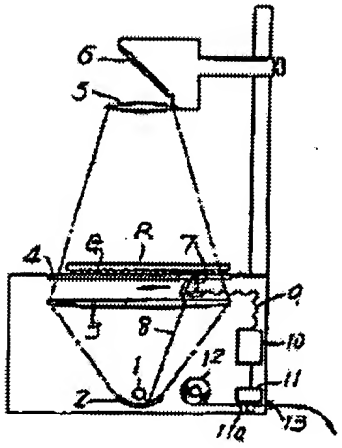
G Original sheet

R Reflective body

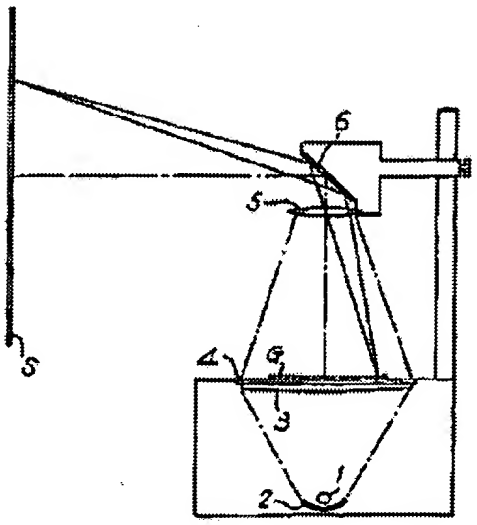
S Screen

K Blackboard, whiteboard, etc.

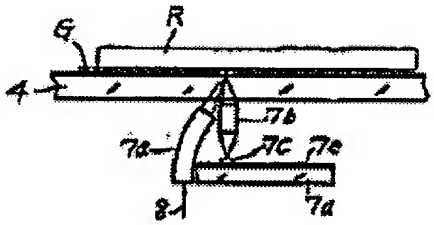
第 1 図



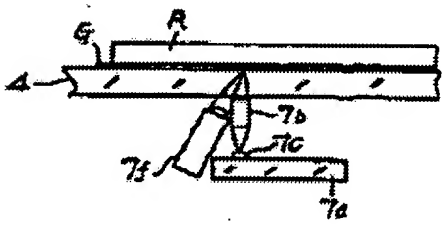
第 2 図



第 3 図



第 4 図



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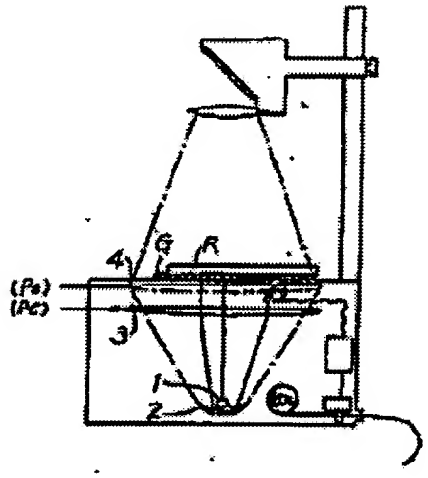

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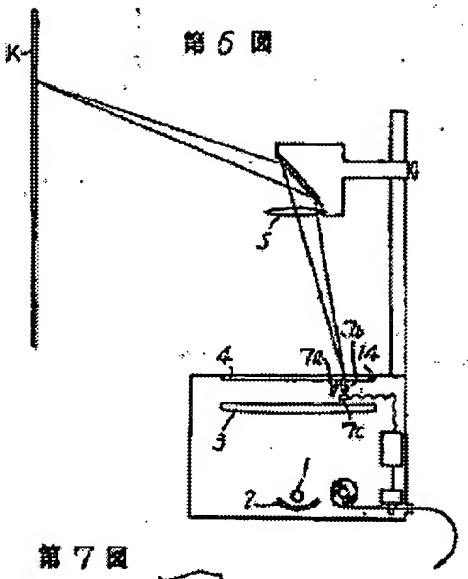

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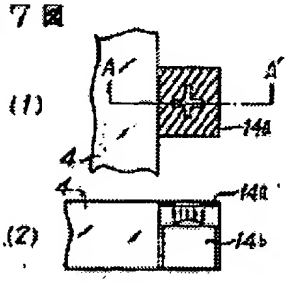

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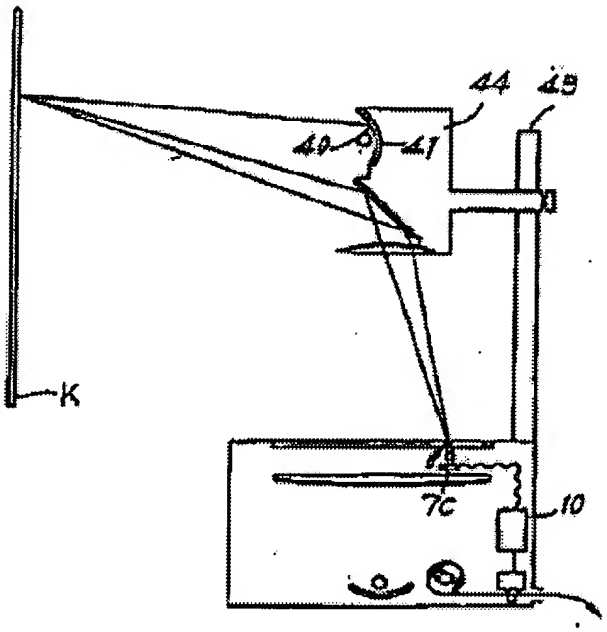

第 9 図